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GB 2135525 A EP 0654821 A2 EP 0180730 A1  
EP 0139431 A2 WO 96/25763 A2

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(54) Abstract Title  
Heat transfer from a single electronic device

(57) To increase heat transfer from a power amplifier 4, through a printed circuit board 2 to a heat sink 6; solid thermally conductive copper pins are inserted into via holes in the circuit board. The pins may be soldered into the holes and the pins may be shorter than the holes. Solder 14, 18 may thermally connect the pins both to the device 4 and the heat sink 6. The assembly may be held together by screws 8.

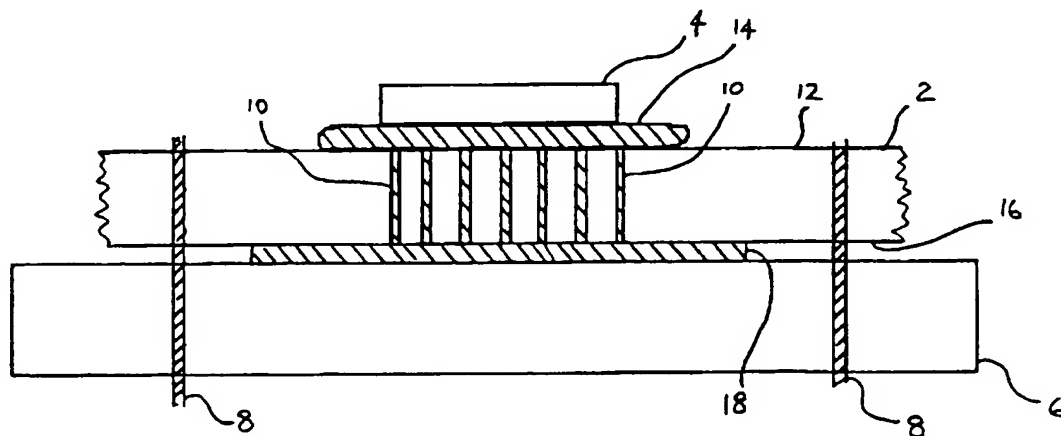


FIGURE 1

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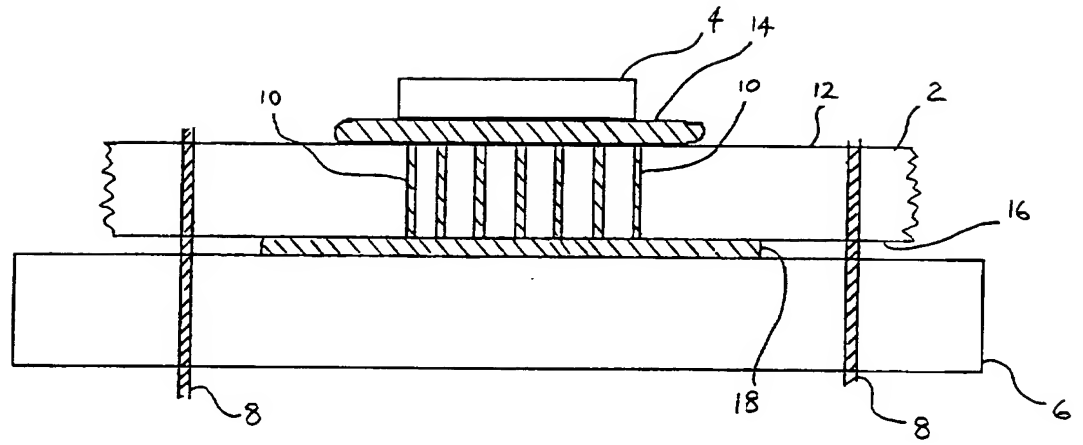


FIGURE 1

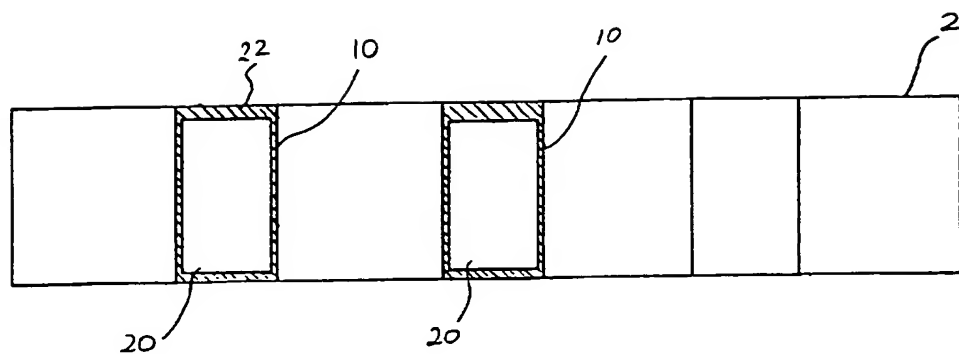


FIGURE 2

HEAT TRANSFERFIELD OF THE INVENTION

5 This invention relates to the field of electronic circuits, and in particular to a technique for cooling a device which generates heat.

BACKGROUND OF THE INVENTION

10 In many electronic circuits, there are components, for example power amplifiers, which generate heat. Since many electronic components have properties which are temperature-dependent, it is necessary to dissipate the heat which is generated, to maintain the circuit within an appropriate operating temperature range.

15 Therefore, when mounting a component such as a power amplifier to a printed circuit board, it is known to mount a heat sink device to the opposite side of the board, and to increase the thermal contact between the power amplifier and the heat sink by filling the via holes through the board, in that region, with solder.

20 However, it is difficult to ensure that the via holes are completely filled, and indeed it is likely that there will be small cavities, which reduce the thermal conductivity, and hence reduce the effectiveness of the arrangement in heat dissipation.

SUMMARY OF THE INVENTION

25 The present invention relates to a manufacturing method which, in preferred embodiments, results in improved thermal contact between a component and a heat sink, and to a circuit produced thereby.

30 In particular, in preferred embodiments of a method in accordance with the invention, an electronic component is mounted to one side of a circuit board and a heat sink is mounted to an opposite side of the circuit board, the circuit having holes passing through. A solid thermally conductive body is included within the hole.

BRIEF DESCRIPTION OF DRAWINGS

Figure 1 is a cross-sectional view of an electronic device in accordance with an aspect of the invention.

5 Figure 2 is an enlarged cross-sectional view through a printed circuit board forming part of the device shown in Figure 1.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS.

10 Figure 1 shows a part of an electronic device, mounted on a printed circuit board 2. A component of the device is a power amplifier 4 which, as is well known, generates heat when in use. Other components of the device are not illustrated, in the interests of clarity.

15 In order to dissipate the heat generated by the power amplifier 4, a heat sink 6, for example in the form of a copper block, is mounted to the printed circuit board 2 by screws 8.

20 The printed circuit board 2 includes a large number of via holes 10 across its whole area, of which only a few are shown in Figure 1. The power amplifier 4 is mounted to an upper surface 12 of the printed circuit board 2 using solder paste 14, and thermal contact between the heat sink 6 and lower surface 16 of the printed circuit board 2 is assured by a further  
25 layer of solder 18.

To this extent, the arrangement of Figure 1 is conventional. However, in the prior art, the via holes 10 are themselves filled with solder, to the largest extent possible.

30 In accordance with the invention, however, and as shown in Figure 2, those via holes 10 in the region close to the power amplifier 4 have a solid thermally conductive body, for example a copper pin 20, press-fitted therein. The area below and above the pin 20, and around the pin to the extent that there is any gap  
35 between the pin 20 and the side walls of the via hole

10, is then filled with solder.

5       The pin which is used is therefore preferably of a length which is close to that of the via holes, but which is, if anything, slightly shorter than the holes, to avoid interfering with the thermal contact between the pin and the adjacent components through the layer of solder. Moreover, the pin is sized to fit as closely as possible into the hole, to maximise its thermal conductivity, consistent with ease of insertion  
10       into the hole.

      Then, the power amplifier 4 can be attached to the printed circuit board 2 using a layer of solder 14 and the heat sink 6 can be thermally contacted therewith through the layer of solder 18 as shown in Figure 1.

15       There is thus disclosed an arrangement which maximises the thermal conductivity from the power amplifier to the heat sink.

CLAIMS

1. A method of mounting an electronic component to a circuit board having first and second sides, the method comprising mounting the component on the first side of said board over at least one hole in the board, and mounting a heat sink on the second side of said board over the or each said hole in the board, and including within said hole a solid thermally conductive body.

2. A method as claimed in claim 1, wherein the thermally conductive body has a cross-sectional shape corresponding to a cross-sectional shape of the hole.

3. A method as claimed in claim 1, wherein the thermally conductive body has a length less than or equal to a thickness of the circuit board.

4. A method as claimed in claim 1, comprising soldering the component to the thermally conductive body.

5. A method as claimed in claim 1, comprising soldering the heat sink to the thermally conductive body.

6. A method as claimed in claim 1, wherein the solid thermally conductive body is included substantially wholly within said hole.

7. A method as claimed in claim 1, wherein the component and the heat sink are mounted over a plurality of holes in the board, each said hole including a solid thermally conductive body therein.

8. An electrical circuit, comprising:  
a circuit board having first and second sides and having a plurality of holes therethrough;  
a heat-generating component mounted to the first side of the board over at least one of the holes;  
a heat sink mounted to the second side of the board over at least one of the same holes as the heat-generating component; and

-5-

a solid thermally conductive body located within  
at least one of said same holes.





Application No: GB 9804402.7  
Claims searched: 1-8

Examiner: Miss E.L.Rendle  
Date of search: 9 June 1998

**Patents Act 1977**  
**Search Report under Section 17**

**Databases searched:**

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:  
UK Cl (Ed.P): H1K (KPDC, KPDD, KPDS, KPDX); H1R (RBK)  
Int Cl (Ed.6): H01L 23/36, 23/367, 23/40; H05K 7/20  
Other: Online: WPI

**Documents considered to be relevant:**

Category	Identity of document and relevant passage	Relevant to claims
X	GB 2 135 525 A (SMITHS) see figures 1 and 3 and column 1 lines 74-79.	1, 2, 5
X	EP 0 654 821 A2 (MOTOROLA) see figure 1 and column 2 lines 39-52.	1, 2, 3, 6.
X	EP 0 180 730 A1 (CONTRAVES) see figures 2 and 3, noting pin 3.	1, 2
X	EP 0 139 431 A2 (LUCAS) see figures 2 and 3.	1, 2, 3, 4, 6, 7, 8.
X	WO 96/25763 A2 (IBM) see whole doc., especially figures 1 and 2 and page 5 lines 21-23, page 10 lines 18-30, page 11 lines 19-26.	1, 2, 3, 6, 7, 8

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.

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